



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

International Patent Classification 6 :

G09G 5/00, G02B 27/14, H04M 11/00

A1

(11) International Publication Number:

WO 97/03434

(43) International Publication Date:

30 January 1997 (30.01.97)

(21) International Application Number: PCT/US96/11632

(22) International Filing Date: 12 July 1996 (12.07.96)

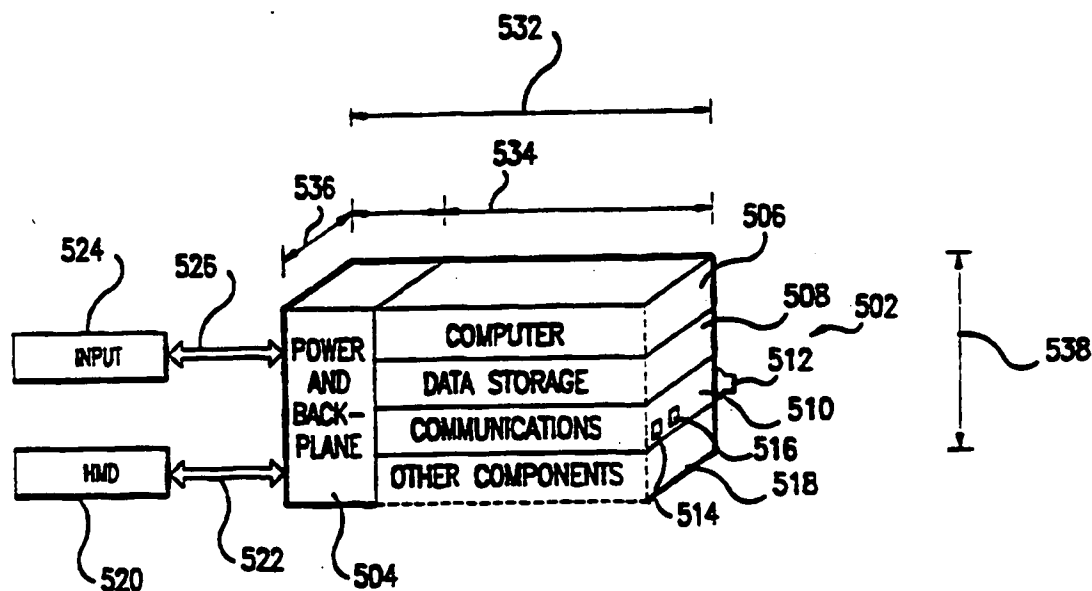
(30) Priority Data:
60/001,069 12 July 1995 (12.07.95) US(71) Applicant: VIRTUAL I/O, INC. [US/US]; Suite 600, 1000
Lenora Street, Seattle, WA 98121 (US).(72) Inventor: AMADON, C., Gregory; 1017 E. Blaine Street,
Seattle, WA 98012 (US).(74) Agent: HUGHES, Richard, L.; Bogle & Gates P.L.L.C., Two
Union Square, 601 Union Street, Seattle, WA 98101-2346
(US).(81) Designated States: CA, JP, European patent (AT, BE, CH, DE,
DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

With international search report.

With a request for rectification under Rule 91.1(f).

(54) Title: ULTRA PORTABLE COMPUTER



Abstract

A portable computer (502) which protects privacy of video and/or audio output is provided. In one embodiment, the computer (502) provides no text or graphic output other than to a head-mounted display (520). In one embodiment, coupling of a head-mounted display (520) to a computer (502) automatically disengages a screen output. In one embodiment, an active state of a screen output is sensed and a warning is provided to a user of a head-mounted display (520).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

ULTRA PORTABLE COMPUTER

The present invention relates to a full-function portable computer which preferably may be smaller than a notebook computer and in particular to a portable computer with a head-mounted display.

BACKGROUND INFORMATION

As the technology used in computing devices has evolved, the limiting factor on the size or "footprint" of a portable computer has been screen size. Attempts to reduce a computer to a footprint smaller than that of the typical "notebook" screen size have not been successful (compared e.g. to the success of the notebook computer) and industry, in general, has operated on the assumption that the notebook size screen defines the smallest commercially practicable full-function portable computer footprint since smaller screen sizes cannot provide the legibility required by the purchasing public for a full function computer (as opposed to smaller-screen special purpose devices such as "personal communication devices" which are not full-function computers, are not used to display the full range of video displayed typically output by a personal computer).

Because of the perception in the industry that the lower limit for the portable computer footprint has been reached, little effort has been expended recently, on further reducing the size of the full-capability portable computer. Instead, efforts generally have been focused on providing greater functionality within the notebook-size footprint. Accordingly, it would be advantageous to provide a more compact full-function personal computer such as one having a size or footprint smaller than that of the notebook computer without sacrificing legibility of video output.

Similar considerations apply to input devices such as keyboards. Some keyboards have been provided which are compact such as being about the size of the notebook display screen. However, despite the fact that such small size keyboards are considered inconvenient or uncomfortable by many users, little effort has been expended on providing more comfortable and convenient input devices since it has been believed, in the past, that full-functionability could not, practically, be achieved in a device having a footprint smaller than the typical notebook computer display device. Thus, there was thought to be little use in expending effort on reducing the size of keyboards or other input devices for full-function computers smaller than the footprint of the notebook computer. Accordingly, it would be advantageous to provide a full-function computer which is not practically limited by the display screen size, so that smaller and/or more portable keyboards can be advantageously provided.

Many previous portable computing devices have been limited in terms of convenience. Currently, users of portable computing devices such as the traveling business person have been burdened by the necessity to carry both a personal notebook-type computer and a cellular telephone, each often having its own batteries and/or battery chargers/AC adapters. This is cumbersome and inconvenient in many circumstances including business circumstances which optimally would provide the ability to set up and communicate within a very short time. Accordingly, it would be useful to provide devices that have

functions formerly provided by separate units such as computers and cellular telephones, while avoiding the need to carry and/or use separate batteries, chargers, and/or adapters.

Portable computing devices previously have been further limited in terms of convenience by requiring that some or all components be manually carried from place to place, such as in a fashion similar to a "notebook" or similar to luggage (portable computer often being provided with carrying cases for this purpose). Accordingly, it would be useful to provide a full-function computer which could be transported more conveniently than by manually carrying the computer, and preferably while reducing the number of separate units which the user must transport, as noted above.

A number of devices have been designed which can provide computer video output directly to the eyes of a user such as by a head-mounted display or helmet-mounted display. Examples of such devices include those described in U.S. Patent 5,303,085, and serial numbers 08/416,838; 08/416,919; 08/416,840 and PCT/US94/01390, incorporated herein by reference. One difficulty with such previous devices is that they are typically configured for use with relatively heavy computers and require the user to be coupled thereto, e.g., by a cable for transmitting the video signal from the computer to the head-mounted display. Even when head-mounted displays are coupled to, for example, laptop computers, such systems are unnecessarily large and heavy, e.g., because these devices provide, typically, a display screen.

Portable computers such as laptop and notebook computers commonly suffer from a number of deficiencies. One such deficiency is that these devices typically provide video output on a screen which provides insufficient privacy protection in the sense that another person can view the screen display "over the shoulder" of the user. Even if a laptop computer user is using an alternative display such as a head-mounted display, there is no convenient and completely satisfactory way of preventing display on the laptop main display screen. Because one who is using an alternative viewing device such as a head-mounted display typically will not be looking at the screen of the computer, there is a risk that unbeknownst to the user, the main display screen of the laptop may switch to a mode which displays on the main screen while the user is using the alternative device, thus compromising privacy. Similar concerns arise from privacy of audio output from a computer which is a growing concern in connection with computers which provide, e.g., synthesized speech or other output which may be sensitive and should be protected from unwanted disclosure to others. Accordingly, it would be advantageous to provide for a portable computer which adequately and conveniently protects privacy of computer output.

SUMMARY OF THE INVENTION

The present invention relates to a computer which provides for ease of use and portability, e.g., for the business traveler, preferably having convenient communication facilities such as cellular phone capability. In one embodiment, the apparatus is extremely compact, having a footprint which is approximately the size of a PCMCIA device. This small footprint can be achieved since it is possible to dispense with the typical display screen by using a head-mounted display for the primary and/or sole

display output. The input device can also be compact such as a foldable keyboard which may communicate with the computer through an infrared, radio or other wireless link. In one embodiment, the computer includes a 486-style processor on a first PCMCIA and a cellular phone on a second PCMCIA, optionally with a hard drive or other memory or storage device on a third PCMCIA, mounted preferably in stacked fashion and coupled to a power supply such as a battery via a backplane/PCMCIA carrier. In one embodiment, the primary output of the computer is a head-mounted display device and the primary input is a wireless keyboard.

In one embodiment, by providing the computer which does not have a built-in display screen, the main chassis of the computer can be provided with a much lighter weight and provided at a lower cost than previously. Furthermore, the requirements for the physical size the computer are reduced. This reduction in weight and/or size requirements can be taken advantage of in several ways. In one configuration, a smaller and/or lighter weight system is provided and the system may be sufficiently small that the device can be conveniently worn by the user, e.g., on a belt loop, shoulder strap, harness, or as part of the head-mounted device. In another embodiment, the system can be provided with a larger keyboard than provided in previous devices without providing a system whose overall size (excluding the head-mounted display, if any) is comparable to that of currently-available systems having a built-in display screen.

A frequent complaint with respect to laptop computers is that the built-in screen display, which is typically an LCD or active matrix display, is difficult to read because of its small size and/or lack of contrast. By providing a private display, the present invention can supply the user with a display having the appearance of a large-size display with contrast which is largely controllable since there is little if any variation in viewing angle.

In one embodiment, the head-mounted display and/or keyboard communicates with the portable computer via a cable. In another embodiment, some or all of the communication is provided using a wireless link such as an infrared communication link, a radio communication link or the like.

In one embodiment of the invention, in order to provide a system which is extremely portable, the device is configured with the folding keyboard. In this way, it is possible for a complete system including input (e.g., keyboard) and output (e.g., video) devices, to be provided which can be easily accommodated in one or more modules that can comfortably be worn, e.g., on a belt loop, etc.

In one embodiment, the full-function computer avoids the need for manual transportation by making some or all components of the full-function device substantially wearable. In one embodiment, the main computing device is sufficiently small and lightweight that it can be worn, e.g., on a belt loop. In another embodiment, the computing device is incorporated into the head-mounted display so that a full-function computer and video display unit is wearable on the user's head. Although it is possible to provide an input device, such as a foldable keyboard, as a separate unit, it is also possible to use headtracker and/or eyetracking as an input device so that the head-mounted computer contains both input and output functions as well as full computing functions all mounted on the user's head.

The present invention provides a system which can be more easily used and accepted by the traveling public, e.g., since such a device can be easily used on an airplane or other transportation mode without the user risking disclosure of sensitive business or other information. Because it is anticipated that the present invention can be used easily during airplane transportation, in one embodiment, the invention also provides for ease of coupling the head-mounted display to display some or all of airline video information such as flight safety information and/or in-flight movies or other entertainment. In one embodiment, the head-mounted display is provided with a coupling which is configured to fit into and operate with either a computer video output device or an aircraft in-flight video output coupler. In another embodiment, the computer is coupled to and receives airline video data such as in-flight entertainment and/or safety video data and outputs to the head-mounted display both information from the airline source and from the computer source, e.g., in a split-screen or picture-within-a-picture mode or in a switchable fashion. Preferably, a device configured in this fashion will be arranged so that safety information and/or emergency information will override computer output so that this information can be provided to the user of the head-mounted display preferentially. In one embodiment, the computer can be coupled to a communication link such as a radiotelephone, mobile telephone, cellular telephone or other communication link so that the user can access remote information while maintaining privacy.

According to one embodiment of the invention, a portable computer is provided with a head-mounted display in such a way that video display privacy can be protected. Preferably, audio output privacy can also be protected. In one embodiment, the portable computer contains no built-in display screen. In this way, there is no danger that the display screen may be inadvertently activated unbeknownst to a privacy display user. In one embodiment, a display screen is provided or can be optionally attached, but the computer is provided with a coupling mechanism whereby when a head-mounted display is coupled to the computer, the screen is automatically disabled from providing output. In one embodiment, the head-mounted display is provided with an audible or visible warning signal when the portable computer screen display (if any) is activated. In one embodiment, similar protection is provided for audio headphone output which may be built integrally with a head-mounted display device. For example, the portable computer can be provided without a built-in speaker or other audio output device. A portable computer can be provided such that when a headphone unit is coupled to the computer, the built-in speaker is automatically disabled. A system can be provided in which a video or audio warning is provided to a user if the built-in speaker of the computer is activated.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a portable computer according to previous devices;

Fig. 2 is a block diagram of a portable computer with privacy output according to an embodiment of the present invention;

Fig. 3 is a drawing of a foldable keyboard according to an embodiment of the present invention;

Fig. 4 is a schematic diagram of an apparatus for disconnecting built-in screen output upon connecting the head-mounted display device;

Fig. 5 is a block diagram of a small-footprint portable computer according to an embodiment of the present invention;

5 Fig. 6 is a perspective partially exploded view of a wearable computer according to an embodiment of the present invention;

Fig. 7 is a perspective view of a combination 386/486 PC computer and cellular phone according to an embodiment of the present invention; and

Fig. 8 is an exploded perspective view of the embodiment of Fig. 7.

10

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in Fig. 1, previous portable computer devices provided a main computer chassis 102 having a CPU 104 coupled to a key board 106 a screen display 108 and typically having a speaker 110. Typically the CPU 104 contains output ports 112a, 112b which can be used for various purposes such as outputting information to auxiliary displays, to headphones, to printers, modems and the like.

Fig. 2 depicts a portable computer according to an embodiment of the present invention. The chassis 102 is not coupled to a screen display. Instead, the chassis 102 is coupled to a head-mounted display 114 and, optionally, headphones 116.

20

Fig. 5 depicts an embodiment in which the apparatus has a footprint with a width and depth similar to the size of a PCMCIA card, i.e., about 8.5cm. by about 12.5cm. In the depicted embodiment, the computer 502 is made up of a column or a stack of PCMCIA cards held in place by coupled PCMCIA carriers adjacent a backplane 504 for communication among the cards and which may also contain the battery or other power source. In the depicted embodiment, a first PCMCIA card 506 includes a processor such as a 386 or 486-type processor and associated buses, memory and input and output devices, such as the type of card available under the trade name Epson card-386 (SLE8632509) and sold by Seiko Epson. In the depicted embodiment, a second PCMCIA card 508 is coupled to the processor card 506 via backplane 504 with the second card 508 containing data storage. A number of data storage devices can be used such as a hard disk, an array of random memory devices, optical storage and the like. One memory device which can be used is that which is available as model EHDD260 ("260MByte Hard drive") from Seiko Epson.

25

30

A third PCMCIA card 510, again coupled by a backplane 504 to the processor card 506, can be used to provide communication capability. In one embodiment, the communication card provides telephone functions, e.g., modem capability for coupling the computer 506 to other computers, to on-line services, to local or national or international networks such as the Internet.

35

The computer is preferably also coupled to a telephone such as a cellular. One type of cellular telephone is that sold under the trade name Ericsson by KRC 113 of 193. The card may be provided with a cellular telephone antenna 512 or may be provided with a telephone T1 jack 514 e.g., for coupling to a land line using an onboard modulator-demodulator (modem). The telephone card 510

can also be provided with a coupler 516 for attaching a handset and/or telephone keypad for using the computer 502 as a voice communication device. Communication to the handset/keypad can be either by way of a cable or through a wireless link such as an infrared or radio link. A number of other components 518 can also be coupled to the computer 506 via the backplane 504 such as auxiliary
5 batteries or other power devices, floppy disk drives, CD-ROM drives, soundboards or other multimedia hardware, and the like.

In the depicted embodiment, video output is via an HMD 520 preferably communicating over a wireless link such as an infrared or radio link 520. An input device such as a keyboard, pen input device, mouse, trackball or joystick 524 can be coupled to the backplane 504 via a wireless link 526.

10 Using this construction, the footprint of the computer 502 has a width 532 of about 14-20cm. which is only slightly larger than the width 534 of the PCMCIA card in its carrier and has a depth 536 approximately equal to the depth of a PCMCIA card and carrier. In one embodiment, the computer 502 has a width 532 of about 19cm. and a depth 536 of about 10cm. The height 538 will depend on how many components and carriers are included in the package. In an embodiment in which only the
15 processor 508, data storage 506 and cellular phone 510 components are included, the height may be, e.g., about 7cm. If a battery pack is attached, the effective height may be greater. Using this configuration, a full functioning computer can be provided 502 which has a relatively small weight.

The device is particularly convenient for a traveler such as a business traveler since the highly compact and lightweight computer 502 is small enough to be conveniently worn, e.g., on a belt,
20 shoulder strap etc. and the input and output 520, 524 can be used without the need to attach via cables.

Further space and weight reduction is obtained by using a common power source 504 for both the computer and the telephone, thus freeing the user from the need to carry separate battery packs, AC converters, chargers and the like for both a telephone and a computer.

In one embodiment, the computer 502 can be provided with audio capability for recording
25 sounds such as voice. In this way, the computer 502 can also function as an electronic dictaphone with the added capability of downloading dictation, instructions etc., at high speed, e.g., over a phone line, Internet, local network etc., for processing by a secretary, word processing department etc. By providing capability of high-speed downloading, the instructions and dictation can be transmitted at minimal telephone or other communications cost.

30 Because the computer 102 does not have a screen display, it is impossible for others to compromise display privacy by viewing a screen "over the shoulder". Similarly, because computer 102 does not have a built-in speaker 110, it is impossible for others to hear audio output which is output by the computer.

In another embodiment, the computer 102 can optionally be coupled to a display screen 108
35 (either built-in, as in the case of common laptop configurations, or attachable by a user. However, in order to assure privacy, it is preferred, in this embodiment, to construct the coupling 118 by which the head-mounted display 114 communicates with the computer 102 in such a way that whenever the head-mounted display 114 is coupled to the computer, the display screen 108 is automatically

decoupled or is automatically configured to warn the HMD user of activation of the screen display. In one embodiment, this is achieved by providing a plug in the computer 102 which receives a complimentary plug at the end of a head-mounted display cable. As depicted in Fig. 4, one socket of the coupling 118 in the computer for receiving a head-mounted display coupler pin 402 has a spring-mounted 406 cap 405 coupled to a lever 408 which controls a switch 410 thus, when the user inserts the head-mounted display cable plug into the computer video port plug 118, pin 402 causes cap 405 to move against the urging of spring 406, moving lever 408 about pivot point 409 opening switch 410. Thus, 410 can be used to control the power supply to the screen 108. A standard shorting jack can also be used for this purpose. In this way, whenever the head-mounted display 114 is plugged into plug 10 118, power to the display screen 108 is automatically disconnected thus assuring that there will be no inadvertent activation of the display 108 while a user is viewing the video output using the head-mounted display 114. If desired, the apparatus can be configured so that the power line providing power to the built-in display 108 is coupled to a sensor 422 which provides screen power status information to the CPU 104. The CPU 104 is configured to output a warning signal to the head-mounted display 114 and/or headphone 116 whenever the sensor 422 senses that the screen 108 is 15 being supplied with power. Thus, the user of the head-mounted display 114 can be provided with a warning that privacy may be compromised. If desired, this warning feature can be provided regardless of whether the plug switch 410 feature is provided.

As depicted in Fig. 3, the keyboard 302 can be provided with two or more sections 304a, 20 304b, 304c which pivot around hinges 306a, 306b so that the keyboard 302 can be folded for carrying and/or storage. This configuration becomes feasible in a computer which does not have a built-in screen 108. Screens 108 typically cannot be folded and thus, in previous devices, the minimum "footprint" that could be provided to a user was largely dependent on the size of the screen. Because users typically require at least a minimum size screen, there was little point in providing key boards 25 which could be folded or otherwise compacted into a smaller shape since the device as a whole could not be smaller than the screen size. In the present invention, however, since it is not necessary to provide a built-in screen, it becomes much more advantageous to take advantage of the ability to fold or otherwise compact other components such as keyboard components as depicted in Fig. 3.

Fig. 6 depicts another embodiment in which the full-function computer is incorporated as part 30 of the head-mounted display to provide a full-function wearable computer, preferably a head-mounted computer. In this embodiment, the HMD includes image sources such as LED rays 602a 602b. A first printed circuit board 604 provides the electronics for driving the image sources 602a 602b, e.g., as described in U.S. patent application serial number 08/416,919, incorporated by reference. A backplane 606 provides for communication among the HMD board 604, the computer PCMCIA 506 and the data 35 storage PCMCIA 508. In this case, the backplane 606 does not contain the power supply or source. Instead, in the depicted embodiment, the housing 100 includes a battery pack or other power supply which communicates via cable 34 with the HMD computer 608. An optional cable 134 can be provided for recharging and/or providing external power to the unit if desired. The housing 100 can, if

desired, also house a headtracker and/or a mechanism for adjusting straps 104a 104b. A cover 610, which may be attached to a forehead brace 612 and may include user controls 614a 614b and/or LED or other lights or indicators 616 covers the electronics 608. The memory device 508 can be used for a number of purposes including storing game software or other software for generating the images to be displayed, storing movies or other audio/video entertainment or presentations and the like.

Although the present inventions has been described by way of a preferred embodiment and certain variations and modifications, other variations and modifications can also be used, the invention being defined by the following claims.

The cellular phone may be integrated with the computer in a number o fashions. They may share the same power source, either simultaneously or switchably. The computer speaker output may be sent to the cellular phone speaker and/or the HMD headset. The cellular phone microphone may provide input to a "soundboard"-type microphone input of the computer or, as noted above, the HMD may have a microphone coupled to it for user voice input, such as for telephone communication and/or voice recognition. If desired voice recognition can be used as the primary input device so that a keyboard may not be necessary. Similarly, although the device can be provided with a mouse input port, it is possible to use eyetracking devices in the HMD to emulate mouse controls. If the HMD provides headphones and a microphone, it is possible to construct the device without a cellularphone "handset", using only the cellularphone printed circuit board and substituting the HMD headset and microphone for the cellularphone speaker and microphone, respectively. The cellular phone can also be integrated with he computer by way of data sharing via a modem which can be integrated on the backplane or PC board of the device with appropriate backplane connections to the cellular phone for enabling data communications over a cellularular telephone link (and/or land line) using the modem. If desired it is possible to integrate the Computer card an phone card and/or the PC board 844 and Phone card onto a single card or board.

The PC board, in addition to providing a substrate for holding the PCMCIA carriers or sockets, and providing communications lines, also can be used for power supply (power conditioning and level control), and to provide computer bus functions ("glue logic"). The board may also provide circuitry for enabling or taking advantage of power saving features of the computer card, wherein functions and/or devices which are unused for at least a certain minimum time are powered-down, preferably so as to permit later powering up substantially without loss of functions or data.

As seen in fig 8, in one embodiment, the device includes a cellularphone upper cover (of the "flip-phone" style) with an area for accessing a speaker, a microphone and a phone-type keypad. the cellular telephone printed circuit board 812 can be any of a number of types such as one from an Ericsson KRC 113193 cellular phone, providing normal cellular phone functions and components such as speaker 814, keypad 816, display 818. Other components include a Hard disk drive card 820, a PCMCIA socket 822, a 386/486 computer PCMCIA 824, a keyboard port 826, a mouse port 828, a jack for an external power supply (such as from an AC/DC converter) 830, a socket for an HMD video

port 835, another PCMCIA socket 836, a back cover 838 and a battery pack 840, which may be of the normal cellular phone battery back style, and a housing 842.

If desired the device can provide an additional PCMCIA slot so a user can easily add further functionality such as additional memory or other functions commonly provided via a PCMCIA

5 connection.

Preferably, the computer is a full function computer operating under a DOS and/or Microsoft Windows operating system or user interface, as opposed to the operating systems of a typical "personal communications device" which is typically not DOS based.

10 In the configuration of Fig 8, a circuit board 844, which is generally parallel to the computer card 824 and memory card 820, provides the functions of the backplane, such as communications among components (bus functions), power supply/regulation, and the like.

WHAT IS CLAIMED IS:

1. A computer system comprising:
a computer chassis having a CPU, defining a footprint with a width less than about 20cm and a depth less than about 10cm;
a head-mounted display coupled to said computer chassis for displaying a video
5 output; and
a cellular telephone coupled to said computer chassis to receive at least power therefrom.
2. A computer system, as claimed in claim 1, wherein said head-mounted display is coupled to said computer chassis via a wireless link.
3. A computer system comprising:
a computer chassis having a CPU;
a head-mounted display coupled to the computer;
at least a first input device coupled to the computer chassis wherein said computer
5 has no built-in output device for providing graphic or text output other than said head-mounted display.
4. A computer system, as claimed in claim 3, wherein said computer chassis includes a cellular telephone board.
5. A computer system, as claimed in claim 3, wherein said input device comprises a keyboard.
6. A computer system, as claimed in claim 5, wherein said keyboard is coupled to said computer chassis via a wireless link.
7. A computer system, as claimed in claim 5, wherein said keyboard includes means for moving portions of the key board with respect to other portions to reconfigure the keyboard between an expanded shape and a compact shape.
8. A computer system, as claimed in claim 3, further comprising means for sensing coupling of a head-mounted display to said computer and, in response, automatically disabling output to a screen display.
9. A computer system, as claimed in claim 3, further comprising means for sensing an active state of a screen display and, in response, outputting a warning to a user.

10. A computer system, as claimed in claim 1, further comprising a keyboard coupled to said computer chassis via a wireless link.

1/6

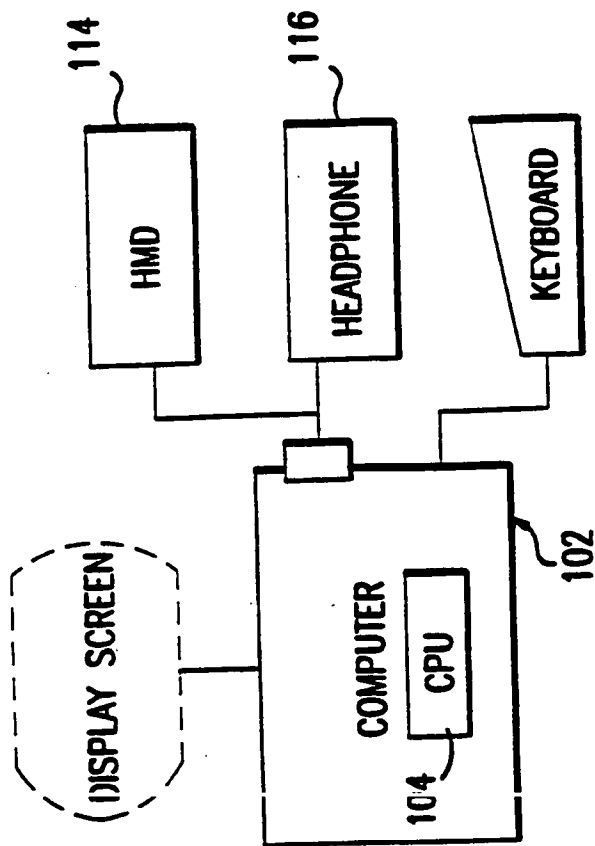


FIG. 2

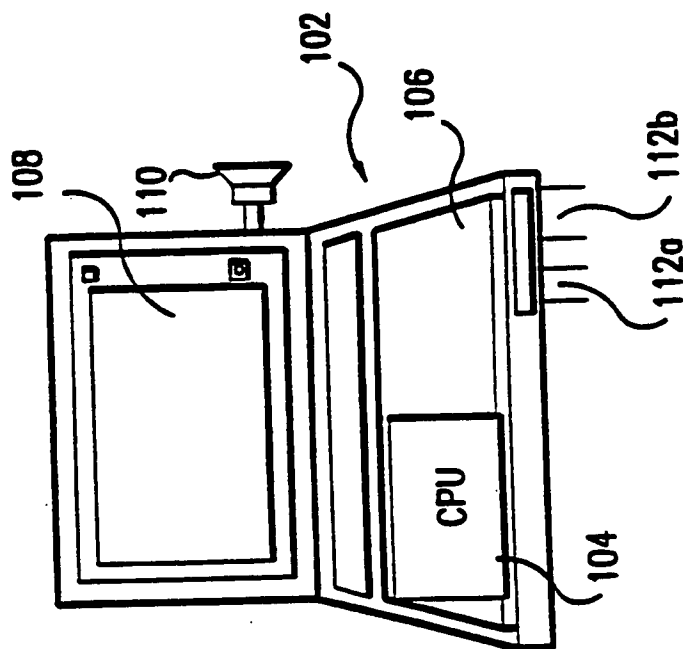


FIG. 1

2/6

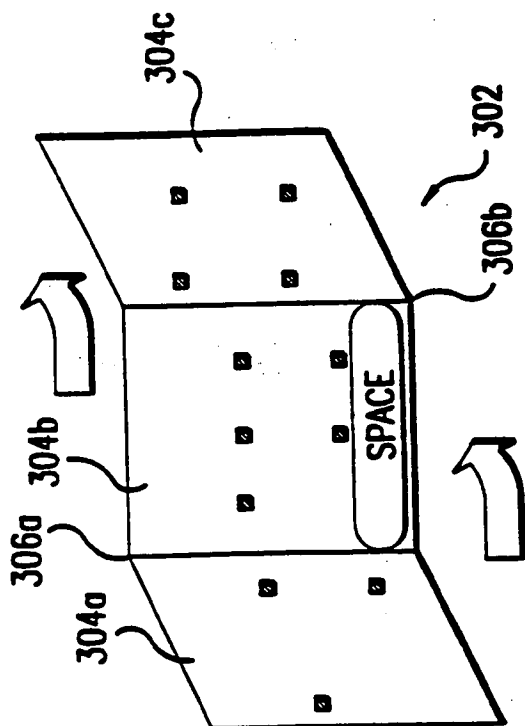


FIG. 3

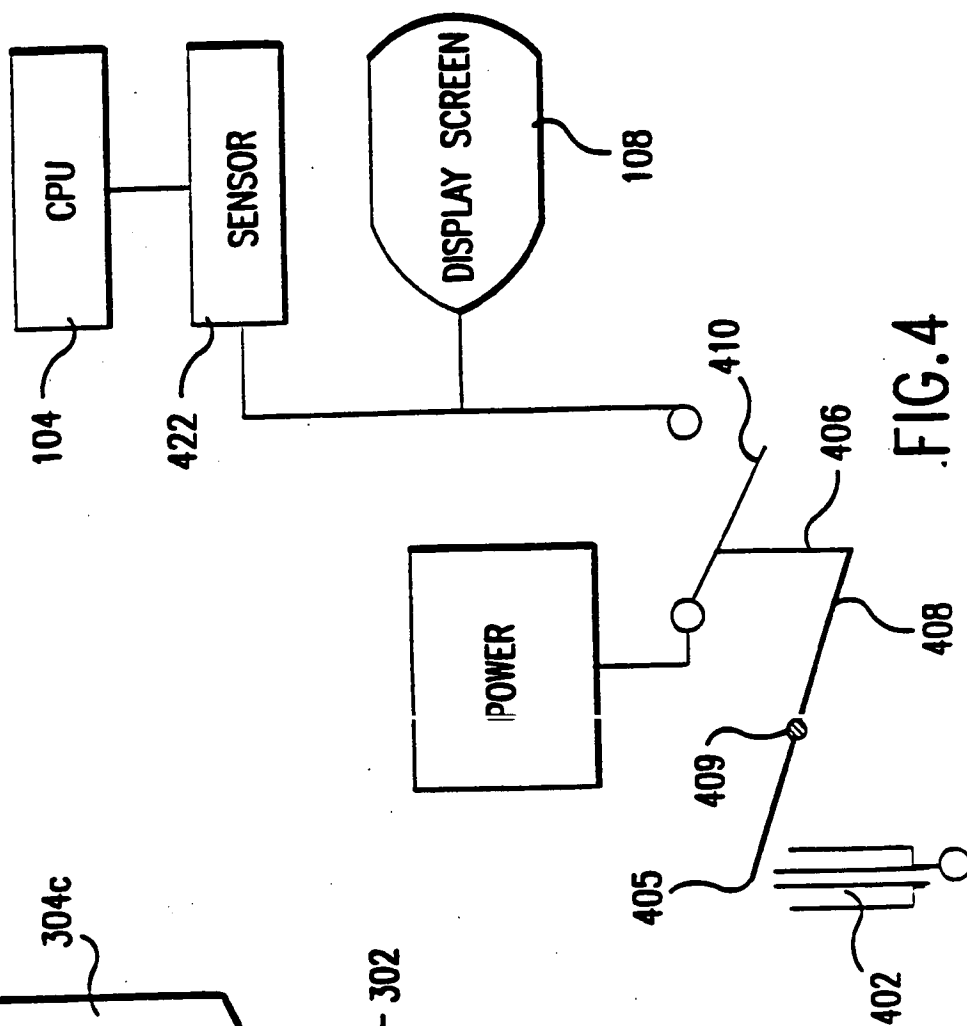


FIG. 4

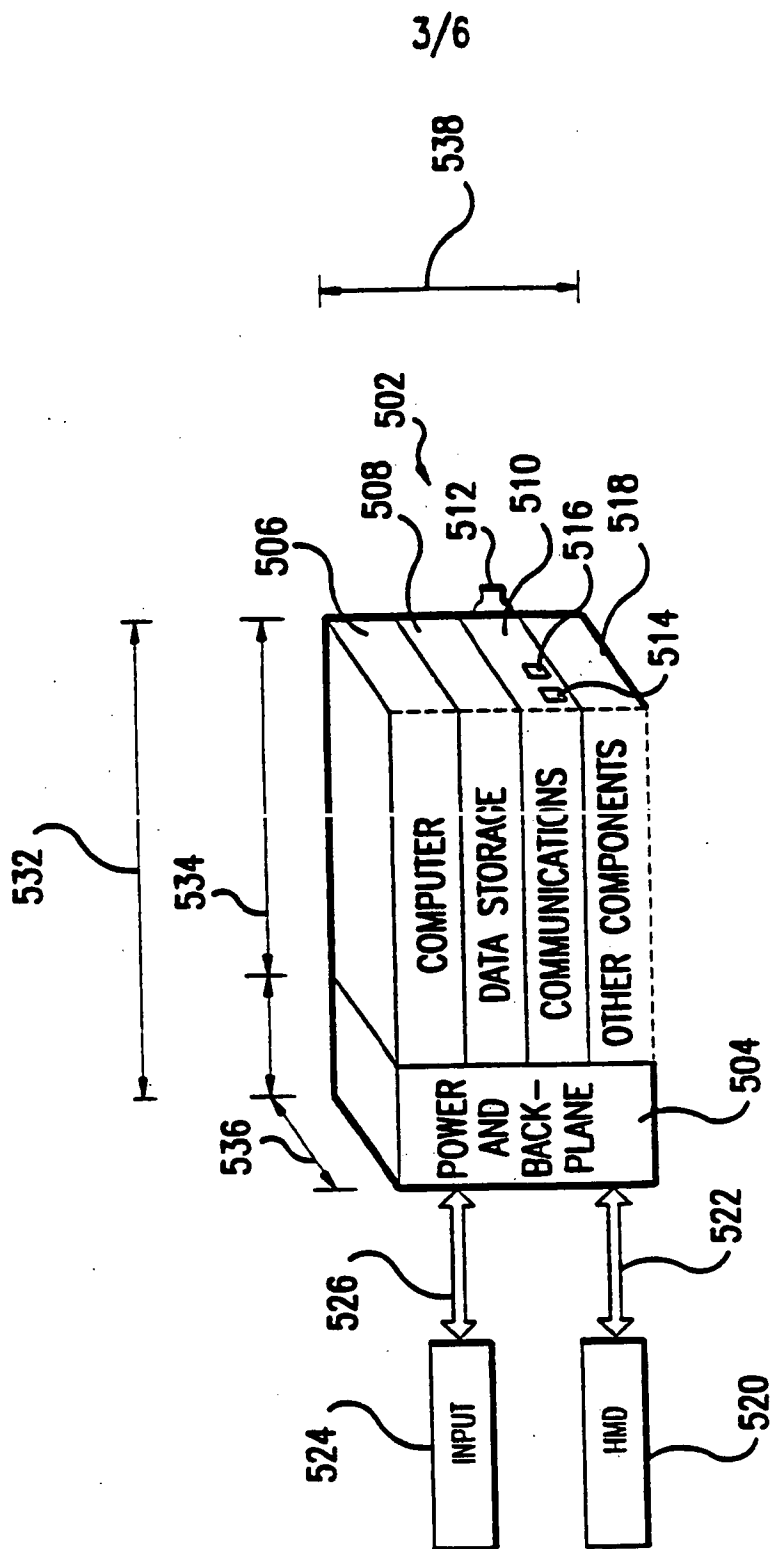


FIG.5

4/6

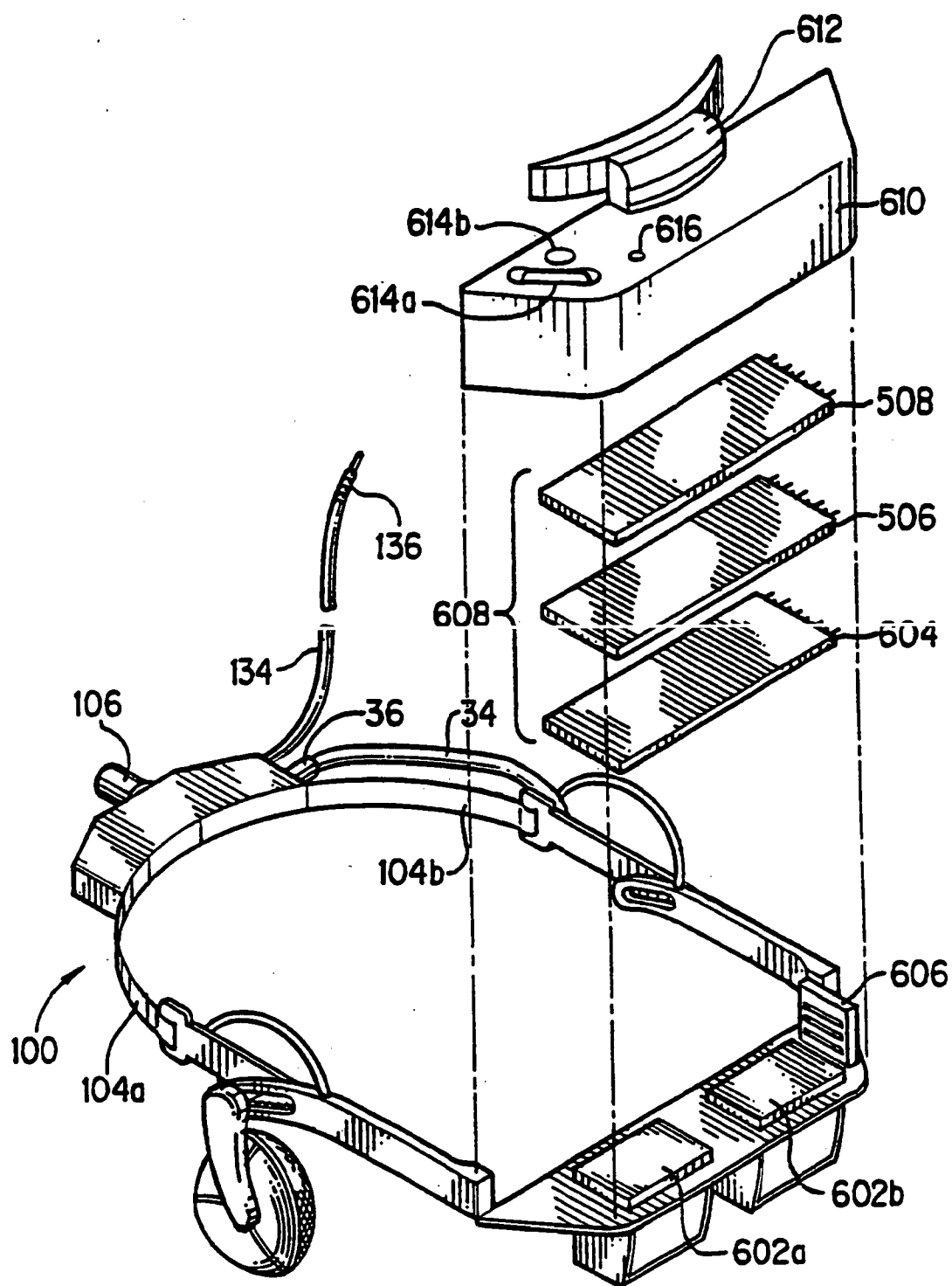
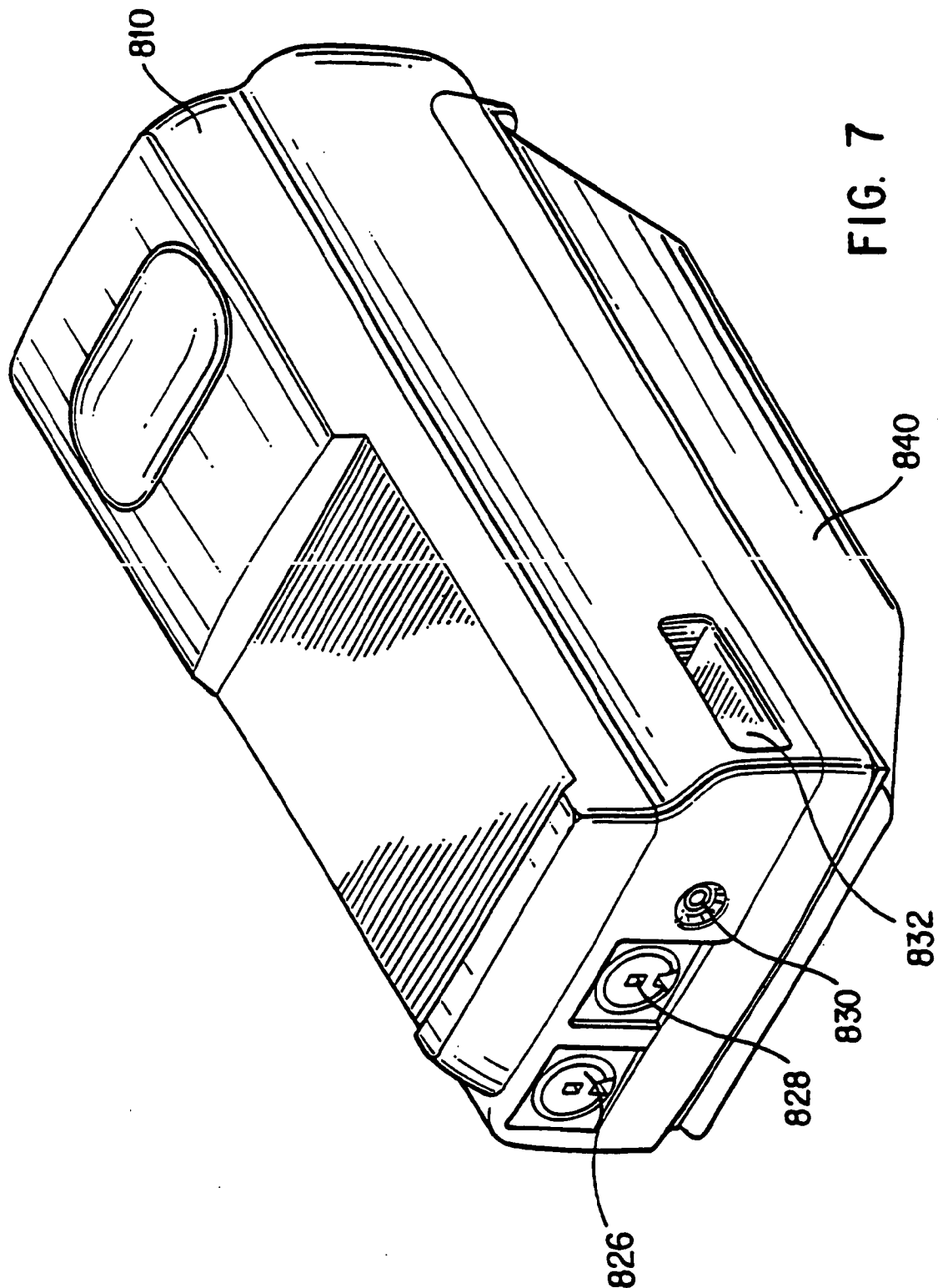
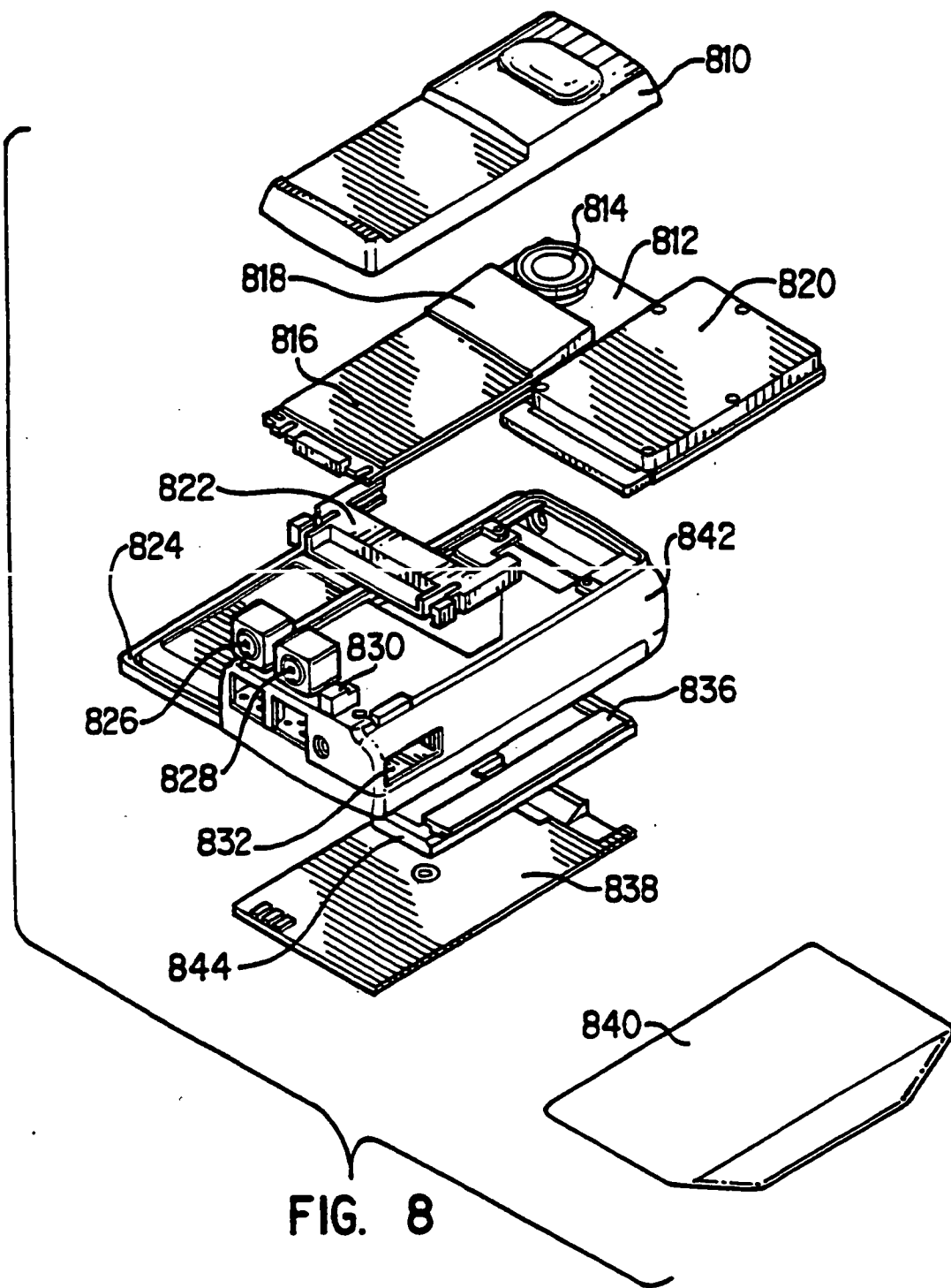


FIG. 6

5/6





INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/11632

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G09G 5/00; G02B 27/14; H04M 11/00

US CL : 345/7, 8, 156; 359/630; 379/59

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/7, 8, 156; 359/630; 379/59

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,281,957 (SCHOOLMAN) 25 January 1994, the abstract, lines 1-2, col 1, lines 22-24, col 2, lines 49-55, lines 63-64, col 3, lines 21-22, lines 36-42, col 4, lines 61-63, line 68, col 5, lines 1-6, col 6, lines 50-51, lines 55-57, col 7, lines 12-17, col 8, lines 19-25.	3, 5, 8
Y	US, A, 5,320,538 (BAUM) 14 June 1994, col 8, lines 1-4, Fig 2.	1
Y	US, A, 5,198,991 (POLLITT) 30 March 1993, the abstract, lines 1-2, col 2, lines 50-51, col 5, lines 33-60, col 7, lines 10-14, col 8, lines 43-53	2
Y	US, A, 5,247,285 (YOKOTA) 21 September 1993, col 12, lines 33-56.	7
		6 & 10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be part of particular relevance	X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G*	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

06 SEPTEMBER 1996

Date of mailing of the international search report

02 OCT 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Telephone No. (703) 305-3230

Authorized officer

MOUSTAFA M. MEKY

Telephone No. (703)305-9697

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/11632

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,995,607 (WHITFIELD) 26 February 1991, col 2, lines 6-9.	9
Y	US, A, 5,127,041 (O'SULLIVAN) 30 June 1992, the abstract, lines 1-2, col 3, lines 28-29, lines 37-39, col 6, lines 7-9, col 12, lines 58-61, lines 66-68.	1 & 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/11632

FIELDS SEARCHED

Electronic data bases consulted (Name of data base and where practicable terms used):

APS

((head or helmet)(w)mounted)(1w)display, wireless or cellular(w)(phone or telephone), (fold### or portion# or segment##)(w)keyboard, computer or laptop or notebook or notepad or palmtop